# PLATING APPARATUS


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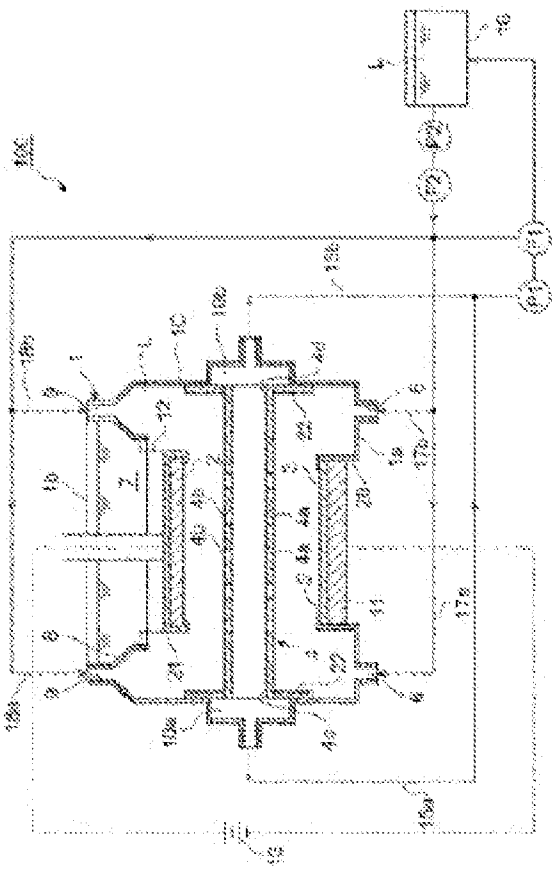
Abstract of **JP2007204801**

PROBLEM TO BE SOLVED: To provide a plating apparatus capable of improving the uniformity of the thickness of a plated film formed on the surface of a substrate. SOLUTION: The plating apparatus is provided with: a plating vessel 1 for storing a plating liquid L; an anode 2 provided in the plating vessel 1; the substrate 3 provided opposite to the anode 2 and functioning as a cathode; a tubular or plate-like hollow member 4 provided between the anode 2 and the substrate 3; and a suction means P1 for sucking the plating liquid L through the hollow member 4. The hollow member 4 has a plurality of suction holes 4a formed in the anode 2 side and discharge ports 4c, 4d for discharging the plating liquid L introduced into the inside of the hollow member 4 through the plurality of the suction holes 4a to the outside of the hollow member 4 by the suction means P1. COPYRIGHT: (C)2007,JPO&INPIT

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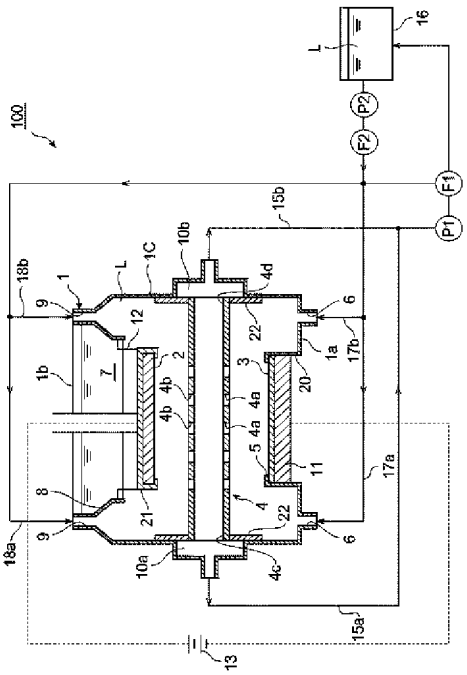
(54)【発明の名称】めっき装置

(57)【要約】
【課題】基板表面上に形成されるめっき膜の厚さの均一性を向上させることができるめっき装置を提供すること。
【解決手段】めっき液Ｌを貯留するめっき槽１と、めっき槽１内に設けられるアノード２と、アノード２に対向して設けられカソードとして機能する基板３と、アノード２及び基板３間に設けられる管状又は板状の中空部材４と、中空部材４を通してめっき液Ｌを吸引させる吸引手段Ｐ１とを備え、中空部材４が、アノード２側に形成される複数の吸引孔４ａと、複数の吸引孔４ａを通して中空部材４の内側に導入されるめっき液Ｌを吸引手段Ｐ１により中空部材４の外側に排出させる排出口４ｃ，４ｄとを有するめっき装置。
【選択図】図１



【特許請求の範囲】
【請求項1】
めっき液を貯留するめっき槽と、
前記めっき槽内に設けられるアノードと、
前記アノードに対向して設けられカソードとして機能する基板と、
前記アノード及び前記基板間に設けられる管状又は板状の中空部材と、
前記中空部材を通して前記めっき液を吸引させる吸引手段と、
を備え、
前記中空部材が、
前記アノード側に形成される複数の吸引孔と、前記複数の吸引孔を通して前記中空部材の内側に導入されるめっき液を前記吸引手段により前記中空部材の外側に排出させる排出口とを有する、
めっき装置。
【請求項2】
前記中空部材において、前記アノードと反対側に複数の吸引孔が更に形成されている、請求項１に記載のめっき装置。
【請求項3】
前記中空部材が水平に配置されている、請求項１又は２に記載のめっき装置。
【請求項4】
前記中空部材が前記排出口を複数備える、請求項１～３のいずれか一項に記載のめっき装置。

【発明の詳細な説明】
【技術分野】
【0001】
本発明は、めっき装置に関するものである。
【背景技術】
【0002】
近年、チップコンデンサ、厚膜インダクタ等の電子部品の小型化に伴い、これら電子部品が薄膜プロセスを経て製造されるようになっている。このような薄膜プロセスの過程では、めっき装置を用いてめっき膜を形成する工程が行われることがある。
【0003】
めっき装置は一般に、めっき液を貯留するめっき槽と、めっき液中に設けられるアノードとを備えており、めっき槽内には、基板がアノードに対向配置されるようになっている。ここで、基板は、一般に全体が導電性材料で構成されるか、表面のみ導電性材料で構成されるものであり、カソードとして機能する。このため、基板とアノードとの間に電圧を印加すると、めっき液中の金属イオンが基板の表面上に付着し、これがめっき膜となる。
【0004】
このようなめっき装置として、従来、例えば下記特許文献１に記載されるものが知られている。このめっき装置では、アノードがめっき液の液面に対して垂直に延びている。そして、めっき液は、めっき槽の底部であってアノードの下端近くに形成されるドレン孔を通して排出され、フィルタにより浄化された後、めっき槽に返送されるようになっている。
【特許文献1】特開２００２－９７５９７号公報
【発明の開示】
【発明が解決しようとする課題】
【0005】
ところで、めっき装置においては一般に、アノード表面に、アノード構成材料の酸化物膜が形成されたり、めっき液中のゴミやスラッジが膜として付着する。これらの膜がアノードの表面上に形成又は付着されると、アノードと基板との間の電界分布が不均一となる可能性が高くなり、基板表面上に形成されるめっき膜を均一に形成することが困難となる

。このため、アノードの表面に付着する膜の厚さを均一にコントロールすることが望まれている。

【0006】

しかしながら、上記特許文献１に記載のめっき装置は以下に示す課題を有していた。

【0007】

即ち上記特許文献１に記載のめっき装置においては、めっき液が、めっき槽の底部であってアノードの下端近くに形成されたドレン孔を通して排出される。このため、アノードの下側でめっき液の流速が大きくなり、上側ではめっき液の流速が小さくなる。このため、アノードの表面に膜が形成されると、アノードの下側の部分については効果的に膜の除去が可能であるが、上側の部分では膜を効果的に除去することができなくなる。その結果、アノード表面に形成される膜の厚さが不均一となり、これに起因して、基板とアノードとの間の電界分布が不均一となり、基板に付着するめっき膜の厚さが不均一となってしまうおそれがあった。

【0008】

本発明は、上記事情に鑑みてなされたものであり、基板表面上に形成されるめっき膜の均一性を向上させることができるめっき装置を提供することを目的とする。

【課題を解決するための手段】

【0009】

上記課題を解決するため、本発明は、めっき液を貯留するめっき槽と、前記めっき槽内に設けられるアノードと、前記アノードに対向して設けられカソードとして機能する基板と、前記アノード及び前記基板間に設けられる管状又は板状の中空部材と、前記中空部材を通して前記めっき液を吸引させる吸引手段と、を備え、前記中空部材が、前記アノード側に形成される複数の吸引孔と、前記複数の吸引孔を通して前記中空部材の内側に導入されるめっき液を前記吸引手段により前記中空部材の外側に排出する排出口とを有する、めっき装置である。

【0010】

このめっき装置によれば、アノードと基板との間に電圧を印加すると、基板のうちアノード側に、めっき液の電解により、めっき液中の金属によるめっき膜が形成される。こうして基板にめっき膜を形成していると、アノードの表面上に、アノードの構成材料の酸化物や、めっき液中のスラッジやゴミなどによる膜が形成される。このとき、吸引手段により、中空部材における複数の吸引孔を通してめっき液が中空部材の内側に吸引され、排出口を通して中空部材の外側に排出されていると、アノードとカソードとの間に設けられる中空部材から、アノード側に形成される複数の吸引孔を通してめっき液が吸引されるため、アノードの表面上に形成される膜を均一に除去することが可能となる。このため、アノードと基板との間の電界分布を均一にすることが可能となり、ひいては基板表面に形成されるめっき膜の厚さの均一性を十分に向上させることができる。

【0011】

上記中空部材においては、アノードと反対側に複数の吸引孔が更に形成されていることが好ましい。

【0012】

この場合、アノード側にのみ複数の吸引孔が形成される場合と比較して、電界分布の乱れを少なくすることが可能となり、基板表面に形成されるめっき膜の厚さの均一性をより十分に向上させることができる。

【0013】

上記中空部材は水平に配置されていることが好ましい。この場合、各吸引孔における液圧が等しくなる。このため、中空部材が水平に配置されていない場合に比べて、各吸引孔における液圧の違いによる吸引力の差をなくすことが可能となり、基板表面に形成されるめっき膜の厚さの均一性をより十分に向上させることができる。

【0014】

上記中空部材は前記排出口を複数備えることが好ましい。

【0015】
この場合、複数の吸引孔を通して中空部材の内側に導入されためっき液を、複数の排出口を通してめっき槽の外側に排出すると、各吸引孔における吸引力の差を十分に小さくすることが可能となる。このため、アノード表面に形成される膜をより均一に除去することが可能となり、ひいては、基板表面上に形成されるめっき膜の厚さの均一性をより十分に向上させることができる。
【発明の効果】
【0016】
本発明のめっき装置によれば、基板表面上に形成されるめっき膜の厚さの均一性を向上させることができる。
【発明を実施するための最良の形態】
【0017】
以下、本発明によるめっき装置の実施形態について図１及び図２を用いて詳細に説明する。
【0018】
図１は、本発明に係るめっき装置の一実施形態を示す縦断面図である。図１に示すように、本実施形態のめっき装置１００は、めっき液Ｌを貯留するめっき槽１と、めっき槽１内に設けられる平板状のアノード２と、アノード２に対向して設けられる平板状の基板３と、アノード２と基板３との間に設けられる管状の中空部材４とを備えている。中空部材４は、めっき槽１内のめっき液Ｌを吸引してめっき槽１の外側に排出するものである。
【0019】
めっき槽１は、底部１ａと、底部１ａに対向する上部１ｂと、上部１ｂと底部１ａとを接続する側壁部１ｃとで構成されている。
【0020】
めっき槽１の底部１ａには、基板３によって閉塞される基板閉塞口５が形成されている。基板閉塞口５は、底部１ａからめっき槽１の内側に向かって延びる筒状のガイド部２０によって形成されている。基板閉塞口５の周囲には、めっき液Ｌを導入する底部めっき液導入口６が形成されている。
【0021】
上部１ｂには、アノード２をめっき槽１の内部に導入するためのアノード導入口７が形成されており、アノード導入口７は、上部１ｂのうち、基板閉塞口５と対向する位置に形成されている。アノード導入口７は、めっき槽１の内側に向かって延びる筒状のガイド部８によって形成されている。アノード導入口７の周囲にも、めっき液Ｌを導入する上部めっき液導入口９が形成されている。
【0022】
側壁部１ｃには、中空部材４から排出されるめっき液Ｌを溜める２つの液溜め部１０ａ，１０ｂが形成されている。具体的には、２つの液溜め部１０ａ，１０ｂは、側壁部１ｃにおける互いに対向する位置にそれぞれ形成されている。
【0023】
このようなめっき槽１に対し、基板閉塞口５は平板状の基板３で閉塞されている。基板３は、基板固定具１１によってガイド部２０に嵌め込まれることにより、基板閉塞口５を閉塞している。即ち基板３は、めっき槽１の外側から容易に脱着可能となっている。従って、基板３の交換作業を容易に行うことができる。
【0024】
アノード２は、アノード保持部２１によって保持されており、アノード保持具２１は、連結具１２を介してガイド部８に固定されている。ここで、アノード導入口７と基板閉塞口５とは対向しており、アノード２は、アノード２の表面が基板３の表面に平行となるように基板３に対向している。アノード２は、本実施形態では銅で構成されるが、銅に限定されるものではない。基板３の表面上に形成しようとするめっき膜に応じて適宜変更すればよい。例えば基板３の表面上に形成しようとするめっき膜が銀である場合には、アノー

ド２も銀で構成すればよい。

【0025】

またアノード２と基板３とは、電源１３を介して電気的に接続されている。従って、電源１３の作動により、アノード２と基板３との間に電圧を印加することが可能となっている。なお、基板３は、導電性材料で構成される層を有していればよい。即ち、全体が導電性材料で構成される層であってもよいし、一部の層のみが導電性材料で構成され残りの層が絶縁性材料で構成されるものであってもよい。

【0026】

図２は、図１の中空部材４を示す斜視図である。アノード２と基板３との間には、図２に示すように、管状の中空部材４が複数本設けられている。具体的には、複数本の管状中空部材４が互いに平行に配置されている。ここで、中空部材４は、アノード２の表面に平行となるように配置されている。なお、中空部材４は、基板３の表面に形成されるめっき膜の厚さの均一性をより向上させる観点からは、めっき液Ｌの液面と平行、即ち水平に配置されていることが好ましい。

【0027】

また複数本の中空部材４の両端は板状部材２２に接続され、板状部材２２によって液溜め部１０ａ，１０ｂが塞がれている。そして、複数本の中空部材４から吸引されためっき液Ｌは、液溜め部１０ａ，１０ｂに集合されるようになっている。

【0028】

ここで、中空部材４について詳細に説明する。各中空部材４においては、アノード２側に複数の吸引孔４ａが形成され、アノード２と反対側、つまり、基板３側にも複数の吸引孔４ｂが形成されている。ここで、より具体的に述べると、複数の吸引孔４ａは、例えば中空状部材４の延び方向に沿って一定間隔で形成されている。また中空部材４の両端には、吸引孔４ａ，４ｂを通して中空部材４の内側に導入されるめっき液Ｌを中空部材４の外側に排出する排出口４ｃ，４ｄが形成されている。吸引孔４ａ，４ｂの孔径は例えば０．５～３００ｍｍとすればよい。

【0029】

中空部材４の両端はそれぞれ、板状部材２２を介してめっき槽１の側壁部１ｃに形成された液溜め部１０ａ，１０ｂに接続されており、吸引孔４ａ，４ｂから吸引されるめっき液Ｌは、２つの液溜め部１０ａ，１０ｂを経てめっき槽１から排出されるようになっている。

【0030】

中空部材４は、導電性材料で構成されても絶縁性材料で構成されてもよいが、アノード２と基板３との間の電界分布をより均一にするという観点からは、絶縁性材料で構成されることが好ましい。このような絶縁性材料としては、例えばセラミック、合成樹脂等を用いることができる。

【0031】

まためっき槽１の側壁部１ｃに形成される２つの液溜め部１０ａ，１０ｂのそれぞれにはめっき液排出管１５ａ，１５ｂが接続されており、めっき液排出管１５ａは、めっき液収容タンク１６に接続され、めっき液排出管１５ｂは、めっき液排出管１５ａの途中で合流している。めっき液排出管１５ａには、めっき液吸引ポンプＰ１が設置されている。このため、めっき液吸引ポンプＰ１の作動により、めっき槽１内のめっき液Ｌが中空部材４の吸引孔４ａ，４ｂを通して吸引され、液溜め部１０ａ，１０ｂを経てめっき槽１から排出されるようになっている。なお、めっき液排出管１５ａには、めっき液フィルタＦ１が設けられてもよい。この場合には、めっき液フィルタＦ１によってブラックフィルム、スラッジ、ゴミ等を除去することが可能となる。本実施形態では、液溜め部１０ａ，１０ｂ、めっき液排出管１５ａ，１５ｂ、めっき液吸引ポンプＰ１によって吸引手段が構成されている。

【0032】

また底部めっき液導入口６にはめっき液導入管１７ａ，１７ｂが接続されており、めっ

き液導入管１７ａはめっき液収容タンク１６に接続され、めっき液導入管１７ｂは、めっき液導入管１７ａの途中で合流している。そして、めっき液導入管１７ａにはめっき液導入ポンプＰ２が設置されている。このため、めっき液収容タンク１６に収容されためっき液Ｌは、めっき液導入ポンプＰ２により、めっき液導入管１７ａ，１７ｂを通して底部めっき液導入口６からめっき槽１内に導入される。なお、めっき液導入管１７ａには、めっき液フィルタＦ２が設けられてもよい。この場合には、めっき液フィルタＦ２によってブラックフィルム、スラッジ、ゴミ等を除去することが可能となる。

【0033】

一方、上部めっき液導入口９にもめっき液導入管１８ａ，１８ｂが接続されており、めっき液導入管１８ｂは、めっき液導入管１８ａのうちめっき液収容タンク１６とめっき液フィルタＦ１との間の部分に接続されている。このため、めっき液排出管１５ａにおいてめっき液フィルタＦ１を通過しためっき液Ｌは、めっき液導入管１８ａ，１８ｂを通して上部めっき液導入口９からめっき槽１内に導入される。

【0034】

次に、上述しためっき装置１００の作用について説明する。

【0035】

まずめっき液導入ポンプＰ２を作動し、めっき液収容タンク１６からめっき液導入管１７ａ，１７ｂ及び底部めっき液導入口６を経てめっき槽１内にめっき液Ｌを導入する。めっき液Ｌは、アノード２及び基板３が浸漬されるまで導入する。そして、めっき液Ｌの液面が所定のレベルに達したらめっき液吸引ポンプＰ２を作動する。これにより、めっき槽１内のめっき液Ｌは、吸引孔４ａ，４ｂから中空部材４に吸引され、液溜め部１０ａ，１０ｂを経てめっき槽１から排出される。そして、液溜め部１０ａ，１０ｂからめっき液排出管１５ａ，１５ｂを経てめっき液収容タンク１６に収容される。こうして、めっき槽１内のめっき液Ｌの導入および排出が行われることにより、めっき液Ｌが常時撹拌される状態となり、めっき液Ｌ中の金属イオンの濃度が均一に維持されることになる。このとき、吸引流量および排出流量は特に制限されない。例えば吸引流量および排出流量は１～２０Ｌ／ｍｉｎの範囲で適宜調整すればよい。

【0036】

次に、電源１３により、アノード２と基板３との間に電圧を印加する。すると、めっき液Ｌの電解により、アノード２を構成する金属が基板３の表面上に付着し、めっき膜が形成される。本実施形態では、アノード２の構成材料として銅が用いられる。このため、基板３の表面上には銅からなるめっき膜が形成される。

【0037】

こうして、めっき液Ｌの電解を継続すると、アノード２の表面上に、銅の酸化物であるブラックフィルムが形成されたり、めっき液Ｌ中のスラッジ、ゴミなどによる膜が付着したりする。この膜は、厚さが不均一になると、アノード２と基板３との間の電界分布を乱すことになるため、基板３の表面上に形成されるめっき膜の厚さの均一性を低下させるおそれがある。

【0038】

ところが、本実施形態では、アノード２と基板３との間に設けられた中空部材４から複数の吸引孔４ａ，４ｂを通してめっき液Ｌが吸引されている。このため、アノード２の表面上に形成される膜を均一に除去することが可能となる。このため、アノード２と基板３との間の電界分布を乱すことが十分に防止され、ひいては基板３の表面に形成されるめっき膜の厚さの均一性が十分に向上する。

【0039】

また、本実施形態では、中空部材４の両端における排出口４ｃ、４ｄからめっき液Ｌが排出される。即ち２箇所からめっき液Ｌが排出される。このため、各吸引孔４ａにおける吸引力の差を小さくすることができ、アノード２の表面に形成される膜をより均一に除去することが可能となり、ひいては基板３の表面に形成されるめっき膜の厚さの均一性をより十分に向上させることができる。

【0040】
即ち、例えば排出口４ｃからのみめっき液Ｌを吸引する場合、排出口４ｃに近い側の吸引孔４ａ，４ｂでは吸引力が大きく、排出口４ｃから遠い側の吸引孔４ａ，４ｂでは吸引力が小さい。このため、排出口４ｃに近い吸引孔４ａ，４ｂと遠い吸引孔４ａ，４ｂとで吸引力の差が大きくなってしまうおそれがある。その点、本実施形態では、もう一方の排出口４ｄからもめっき液Ｌが吸引されるため、排出口４ｃから遠い吸引孔４ａ，４ｂにおける吸引力の低下が十分に防止される。よって、各吸引孔４ａ，４ｂにおける吸引力の差を十分に小さくすることができ、ひいては基板３の表面に形成されるめっき膜の均一性をより十分に向上させることができる。なお、この発明は、管状の中空部材４が短い場合よりも長い場合に特に有効である。
【0041】
また本実施形態において、中空部材４が水平に配置される場合、各吸引孔４ａにおける液圧が等しくなる。このため、中空部材が水平に配置されていない場合に比べて、各吸引孔における液圧の違いによる吸引力の差を小さくすることが可能となり、基板３の表面に形成されるめっき膜の均一性をより十分に向上させることができる。
【0042】
本発明は、上記実施形態に限定されるものではない。例えば上記実施形態では、中空部材４が管状となっているが、本発明のめっき装置を構成する中空部材は、図３に示すように板状であってもよい。この場合の中空部材２４は、図３に示すように、一対の板状部２５ａ，２５ｂと、一対の板状部２５ａ，２５ｂを連結する環状の側壁部２６とで構成されている。板状部２５ａには、図示しない複数の吸引孔が形成され、板状部２５ｂには、複数の吸引孔２７ｂが形成されている。そして、側壁部２６には、吸引孔２７ｂを通して中空部材２４の内側に導入されためっき液を中空部材２４の外側に排出させる複数の排出口２８が形成されている。なお、この場合、各排出口２８には、図３の二点鎖線で示されるように、中空部材２４の内側のめっき液を液溜め部１０ａ，１０ｂに導くチューブ２９が接続される。
【実施例】
【0043】
以下、本発明の内容を、実施例を用いてより具体的に説明するが、本発明は、下記実施例に限定されるものではない。
【0044】
（実施例１）
図１に示すめっき装置を用いて以下のようにして基板の表面上にめっき膜を形成した。即ちまずめっき液導入ポンプＰ２を作動し、めっき液収容タンク１６からめっき液導入管１７ａ，１７ｂ及び底部めっき液導入口６を経てめっき槽１内にめっき液Ｌを導入した。このとき、めっき液Ｌは、硫酸銅・５水和物（$CuSO_4 \cdot 5H_2O$）、硫酸（$H_2SO_4$）、塩酸（ＨＣｌ）、ポリエチレングリコールで構成した。めっき液Ｌは、アノード２及び基板３が浸漬されるまで導入した。そして、めっき液Ｌの液面が所定のレベルに達したらめっき液吸引ポンプＰ１を作動し、めっき槽１からめっき液Ｌを排出させた。このとき、吸引流量および排出流量はいずれも１０Ｌ／ｍｉｎとした。
【0045】
次に、電源１３により、アノード２と基板３との間の電流密度が２Ａ／ｄｍ$^2$となるようにアノード２と基板３との間に電圧を印加した。こうして基板３の表面上に、銅からなるめっき膜を形成した。
【0046】
こうして形成しためっき膜について、接触式膜厚測定装置（触針式表面形状測定器、Ｄｅｋｔａｋ製）により、厚さのバラツキを調べた。その結果、めっき膜の平均厚さは１０μｍであり、平均厚さからのバラツキは、±５％であり、十分に小さいことが分かった。
【0047】
このことから、本発明のめっき装置によれば、基板表面上に形成されるめっき膜厚の均

一性を十分に向上させることができることが確認された。

【図面の簡単な説明】

【0048】

【図1】図１は、本発明に係るめっき装置の一実施形態を示す縦断面図である。

【図2】図２は、図１の中空部材を示す斜視図である。

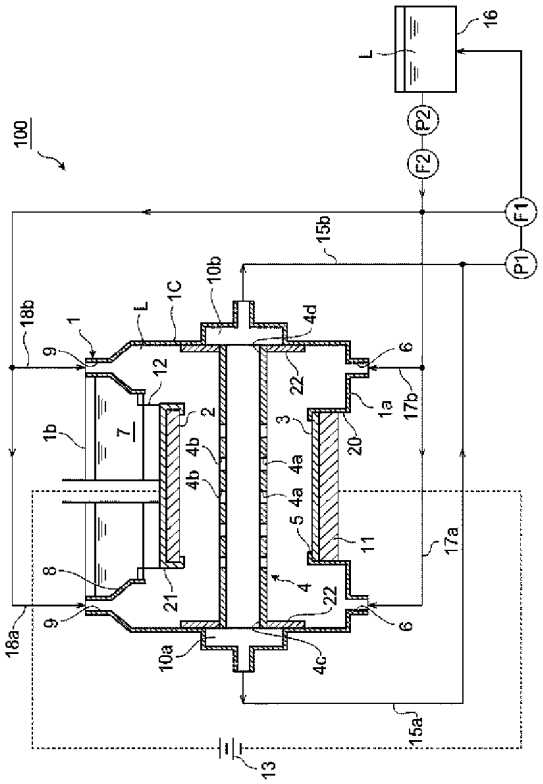
【図3】図３は、中空部材の変形例を示す斜視図である。

【符号の説明】

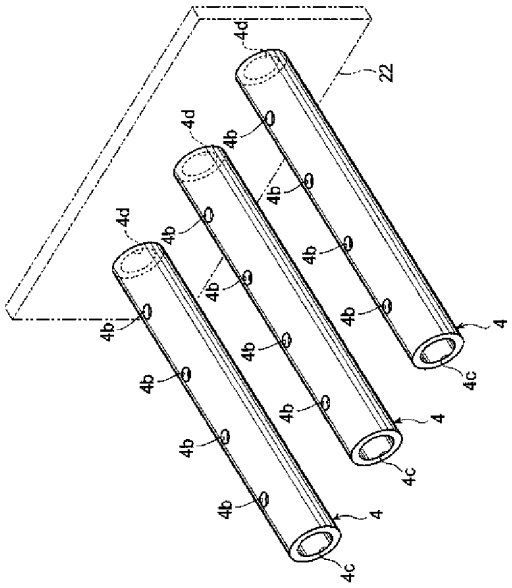
【0049】

１…めっき槽、２…アノード、３…基板、４…中空部材、４ａ，４ｂ…吸引孔、４ｃ，４ｄ…排出口、１００…めっき装置。

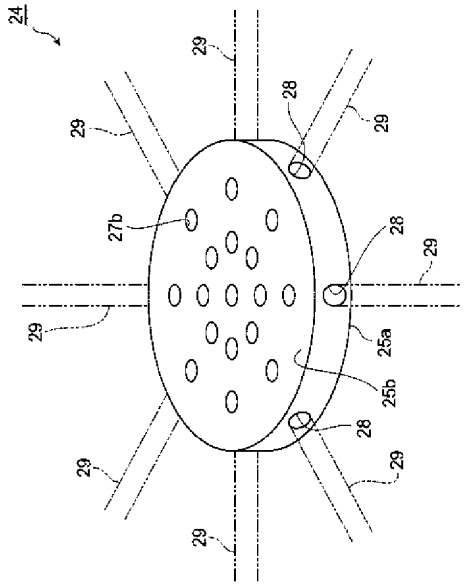
【図1】




【図2】



【図3】



**INFORMAL ENGLISH TRANSLATION OF**
**JAPANESE REFERENCE NO. 2007-204801**

* NOTICES *



1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

## TECHNICAL FIELD

[Field of the Invention]
[0001]
This invention relates to a plating device.

[Translation done.]

* NOTICES *



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## PRIOR ART

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[Background of the Invention]
[0002]
In recent years, these electronic parts are manufactured through a thin film process with the miniaturization of electronic parts, such as a chip capacitor and a thick film inductor. In the process of such a thin film process, the process of forming a plating film using a plating device may be performed.
[0003]
Generally the plating device is provided with the plating tub which stores plating liquid, and the anode provided into plating liquid, and the placed opposite of the substrate is carried out to an anode into a plating tub. Here, generally the whole comprises a conductive material or a substrate comprises a conductive material only the surface.
It functions as a cathode.
For this reason, if voltage is impressed between a substrate and an anode, the metal ion in plating liquid will adhere on the surface of a substrate, and this will serve as a plating film.
[0004]
As such a plating device, what is indicated to the conventional, for example, the following, patent documents 1 is known. In this plating device, the anode is vertically prolonged to the oil level of plating liquid. And after plating liquid is discharged through the drain hole which is a pars basilaris ossis occipitalis of a plating tub, and is formed near the lower end of an anode and purified by the filter, it is returned to a plating tub.
[Patent documents 1] JP,2002-97597,A

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[Translation done.]

## TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention]
[0005]
By the way, in a plating device, the oxide film of an anode component is formed in the anode surface, or, generally the garbage and sludge in plating liquid adhere as a film. If it forms or adheres to these films on the surface of an anode, a possibility that the electric field distribution between an anode and a substrate will become uneven will become high, and it will become difficult to form uniformly the plating film formed on a substrate face. For this reason, to control uniformly the thickness of the film which adheres on the surface of an anode is desired.
[0006]
However, the plating device given in the above-mentioned patent documents 1 had a technical problem shown below.
[0007]
That is, in a plating device given in the above-mentioned patent documents 1, plating liquid is discharged through the drain hole which is a pars basilaris ossis occipitalis of a plating tub, and was formed near the lower end of an anode. For this reason, the rate of flow of plating liquid becomes large with the anode down side, and the rate of flow of plating liquid becomes small with the up side. If a film is formed on the surface of an anode, about the portion of the anode bottom, membranous removal is effectively possible, but it becomes impossible for this reason, to remove a film effectively in an upper portion. As a result, there was a possibility that the thickness of the film formed in the anode surface may become uneven, might originate in this, the electric field distribution between a substrate and an anode might become uneven, and the thickness of the plating film adhering to a substrate might become uneven.
[0008]
In light of the above-mentioned circumstances, this invention is a thing.
the purpose is to provide the plating device which can raise the homogeneity of the plating film boiled and formed.

[Translation done.]

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## MEANS

[Means for Solving the Problem]
[0009]
A plating device this invention is characterized by that comprises the following in order to solve an aforementioned problem.
A plating tub which stores plating liquid.
An anode provided in said plating tub.
A substrate which counters said anode, is formed and functions as a cathode.
A tubular or tabular hollow member provided between said anode and said substrate, An outlet which is provided with a suction means which makes said plating liquid attract through said hollow member and to which said hollow member discharges plating liquid introduced inside said hollow member through two or more suction holes formed in said anode side, and said two or more suction holes on the outside of said hollow member by said suction means.

[0010]
According to this plating device, if voltage is impressed between an anode and a substrate, a plating film by metal in plating liquid will be formed in the anode side by electrolysis of plating liquid among substrates. In this way, if a plating film is formed in a substrate, a film by an oxide of a component of an anode, sludge in plating liquid, garbage, etc. will be formed on the surface of an anode. If plating liquid is attracted inside a hollow member through two or more suction holes which can be set to a hollow member and it is discharged by the outside of a hollow member through an outlet by a suction means at this time, Since plating liquid is attracted through two or more suction holes formed in the anode side from a hollow member provided between an anode and a cathode, it becomes possible to remove uniformly a film formed on the surface of an anode. For this reason, the homogeneity of thickness of a plating film which it becomes possible to make uniform electric field distribution between an anode and a substrate, and is formed in a substrate face by extension can fully be raised.
[0011]
In the above-mentioned hollow member, it is preferred that two or more suction holes are further formed in an anode and an opposite hand.
[0012]
In this case, as compared with a case where two or more suction holes are formed only in the anode side, it can become possible to lessen disorder of electric field distribution, and the homogeneity of thickness of a plating film formed in a substrate face can more fully be raised.
[0013]
As for the above-mentioned hollow member, being arranged horizontally is preferred. In this case, fluid pressure in each suction hole becomes equal. For this reason, compared with a case where a hollow member is not arranged horizontally, it can become possible to abolish a difference of a

suction force by difference in fluid pressure in each suction hole, and the homogeneity of thickness of a plating film formed in a substrate face can more fully be raised.

[0014]

As for the above-mentioned hollow member, it is preferred to have two or more said outlets.

[0015]

In this case, if plating liquid introduced inside a hollow member through two or more suction holes is discharged on the outside of a plating tub through two or more outlets, it will become possible to make small enough a difference of a suction force in each suction hole. For this reason, the homogeneity of thickness of a plating film which it becomes possible to remove more a film formed in the anode surface to homogeneity, and is formed on a substrate face by extension can more fully be raised.

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## EFFECT OF THE INVENTION

[Effect of the Invention]
[0016]
According to the plating device of this invention, the homogeneity of the thickness of the plating film formed on a substrate face can be raised.

[Translation done.]

* NOTICES *



## EXAMPLE

[Example]
[0043]
Hereafter, although the contents of this invention are more concretely explained using an example, this invention is not limited to the following example.
[0044]
(Example 1)
The plating film was formed on the surface of a substrate as follows using the plating device shown in drawing 1. That is, the plating liquid introduction pump P2 was operated first, and the plating liquid L was introduced in the plating tub 1 through the plating liquid introducing pipes 17a and 17b and the pars-basilaris-ossis-occipitalis plating liquid feed port 6 from the plating liquid accommodation tank 16. At this time, the plating liquid L consisted of copper sulfate and 5 hydrate ($CuSO_4$and$5H_2O$), sulfuric acid ($H_2SO_4$), chloride (HCl), and a polyethylene glycol. The plating liquid L was introduced until the anode 2 and the substrate 3 were immersed. And when the oil level of the plating liquid L reached the predetermined level, the plating liquid suction pump P1 was operated, and the plating liquid L was made to discharge from the plating tub 1. At this time, each of suction flow rates and exhaust flows was taken as 10 L/min.
[0045]
Next, according to the power supply 13, voltage was impressed between the anode 2 and the substrate 3 so that the current density between the anode 2 and the substrate 3 might serve as 2 $A/dm^2$. In this way, the plating film which consists of copper was formed on the surface of the substrate 3.
[0046]
In this way, about the formed plating film, the variation in thickness was investigated with the contact process thickness measurement device (a sensing pin type surface type-like measuring instrument, the product made from Dektak). As a result, the average thickness of a plating film is 10 micrometers, and the variation from average thickness is **5%.
It turned out that it is sufficiently small.

[0047]
According to the plating device of this invention, from this, it was checked that the homogeneity of the plating thickness formed on a substrate face can fully be raised.

[Translation done.]

* NOTICES *



## DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[0048]
[Drawing 1]Drawing 1 is drawing of longitudinal section showing one embodiment of the plating device concerning this invention.
[Drawing 2]Drawing 2 is a perspective view showing the hollow member of drawing 1.
[Drawing 3]Drawing 3 is a perspective view showing the modification of a hollow member.

[Translation done.]

* NOTICES *



## DETAILED DESCRIPTION

[Detailed Description of the Invention]
[Field of the Invention]
[0001]
This invention relates to a plating device.
[Background of the Invention]
[0002]
In recent years, these electronic parts are manufactured through a thin film process with the miniaturization of electronic parts, such as a chip capacitor and a thick film inductor. In the process of such a thin film process, the process of forming a plating film using a plating device may be performed.
[0003]
Generally the plating device is provided with the plating tub which stores plating liquid, and the anode provided into plating liquid, and the placed opposite of the substrate is carried out to an anode into a plating tub. Here, generally the whole comprises a conductive material or a substrate comprises a conductive material only the surface.
It functions as a cathode.
For this reason, if voltage is impressed between a substrate and an anode, the metal ion in plating liquid will adhere on the surface of a substrate, and this will serve as a plating film.
[0004]
As such a plating device, what is indicated to the conventional, for example, the following, patent documents 1 is known. In this plating device, the anode is vertically prolonged to the oil level of plating liquid. And after plating liquid is discharged through the drain hole which is a pars basilaris ossis occipitalis of a plating tub, and is formed near the lower end of an anode and purified by the filter, it is returned to a plating tub.
[Patent documents 1] JP,2002-97597,A
[Description of the Invention]
[Problem(s) to be Solved by the Invention]
[0005]
By the way, in a plating device, the oxide film of an anode component is formed in the anode surface, or, generally the garbage and sludge in plating liquid adhere as a film. If it forms or adheres to these films on the surface of an anode, a possibility that the electric field distribution between an anode and a substrate will become uneven will become high, and it will become difficult to form uniformly the plating film formed on a substrate face. For this reason, to control uniformly the thickness of the film which adheres on the surface of an anode is desired.
[0006]
However, the plating device given in the above-mentioned patent documents 1 had a technical problem shown below.

[0007]
That is, in a plating device given in the above-mentioned patent documents 1, plating liquid is discharged through the drain hole which is a pars basilaris ossis occipitalis of a plating tub, and was formed near the lower end of an anode. For this reason, the rate of flow of plating liquid becomes large with the anode down side, and the rate of flow of plating liquid becomes small with the up side. If a film is formed on the surface of an anode, about the portion of the anode bottom, membranous removal is effectively possible, but it becomes impossible for this reason, to remove a film effectively in an upper portion. As a result, there was a possibility that the thickness of the film formed in the anode surface may become uneven, might originate in this, the electric field distribution between a substrate and an anode might become uneven, and the thickness of the plating film adhering to a substrate might become uneven.
[0008]
In light of the above-mentioned circumstances, this invention is a thing.
the purpose is to provide the plating device which can raise the homogeneity of the plating film boiled and formed.

[Means for Solving the Problem]
[0009]
A plating device this invention is characterized by that comprises the following in order to solve an aforementioned problem.
A plating tub which stores plating liquid.
An anode provided in said plating tub.
A substrate which counters said anode, is formed and functions as a cathode.
A tubular or tabular hollow member provided between said anode and said substrate, An outlet which is provided with a suction means which makes said plating liquid attract through said hollow member and to which said hollow member discharges plating liquid introduced inside said hollow member through two or more suction holes formed in said anode side, and said two or more suction holes on the outside of said hollow member by said suction means.

[0010]
According to this plating device, if voltage is impressed between an anode and a substrate, a plating film by metal in plating liquid will be formed in the anode side by electrolysis of plating liquid among substrates. In this way, if a plating film is formed in a substrate, a film by an oxide of a component of an anode, sludge in plating liquid, garbage, etc. will be formed on the surface of an anode. If plating liquid is attracted inside a hollow member through two or more suction holes which can be set to a hollow member and it is discharged by the outside of a hollow member through an outlet by a suction means at this time, Since plating liquid is attracted through two or more suction holes formed in the anode side from a hollow member provided between an anode and a cathode, it becomes possible to remove uniformly a film formed on the surface of an anode. For this reason, the homogeneity of thickness of a plating film which it becomes possible to make uniform electric field distribution between an anode and a substrate, and is formed in a substrate face by extension can fully be raised.
[0011]
In the above-mentioned hollow member, it is preferred that two or more suction holes are further formed in an anode and an opposite hand.
[0012]
In this case, as compared with a case where two or more suction holes are formed only in the anode side, it can become possible to lessen disorder of electric field distribution, and the homogeneity of thickness of a plating film formed in a substrate face can more fully be raised.
[0013]

As for the above-mentioned hollow member, being arranged horizontally is preferred. In this case, fluid pressure in each suction hole becomes equal. For this reason, compared with a case where a hollow member is not arranged horizontally, it can become possible to abolish a difference of a suction force by difference in fluid pressure in each suction hole, and the homogeneity of thickness of a plating film formed in a substrate face can more fully be raised.
[0014]
As for the above-mentioned hollow member, it is preferred to have two or more said outlets.
[0015]
In this case, if plating liquid introduced inside a hollow member through two or more suction holes is discharged on the outside of a plating tub through two or more outlets, it will become possible to make small enough a difference of a suction force in each suction hole. For this reason, the homogeneity of thickness of a plating film which it becomes possible to remove more a film formed in the anode surface to homogeneity, and is formed on a substrate face by extension can more fully be raised.
[Effect of the Invention]
[0016]
According to the plating device of this invention, the homogeneity of the thickness of the plating film formed on a substrate face can be raised.
[Best Mode of Carrying Out the Invention]
[0017]
Hereafter, the embodiment of the plating device by this invention is described in detail using drawing 1 and drawing 2.
[0018]
Drawing 1 is drawing of longitudinal section showing one embodiment of the plating device concerning this invention. As shown in drawing 1, the plating device 100 of this embodiment is provided with the following.
The plating tub 1 which stores the plating liquid L.
The plate-like anode 2 provided in the plating tub 1.
The plate-like substrate 3 which counters the anode 2 and is formed.
The tubular hollow member 4 provided between the anode 2 and the substrate 3.
The hollow member 4 attracts the plating liquid L in the plating tub 1, and discharges it on the outside of the plating tub 1.
[0019]
The plating tub 1 comprises the side wall part 1c which connects the pars basilaris ossis occipitalis 1a, the upper part 1b which counters the pars basilaris ossis occipitalis 1a, and the upper part 1b and the pars basilaris ossis occipitalis 1a.
[0020]
The substrate blockade mouth 5 blockaded by the substrate 3 is formed in the pars basilaris ossis occipitalis 1a of the plating tub 1. The substrate blockade mouth 5 is formed of the tubed guide part 20 prolonged toward the inside of the plating tub 1 from the pars basilaris ossis occipitalis 1a. The pars-basilaris-ossis-occipitalis plating liquid feed port 6 which introduces the plating liquid L is formed in the circumference of the substrate blockade mouth 5.
[0021]
The anode feed port 7 for introducing the anode 2 into the inside of the plating tub 1 is formed in the upper part 1b, and the anode feed port 7 is formed in the substrate blockade mouth 5 and the position which counters among the upper parts 1b. The anode feed port 7 is formed of the tubed guide part 8 prolonged toward the inside of the plating tub 1. The top plating liquid feed port 9 which introduces the plating liquid L also into the circumference of the anode feed port 7 is formed.
[0022]

The two liquid pool parts 10a and 10b which collect the plating liquid L discharged from the hollow member 4 are formed in the side wall part 1c. Specifically, the two liquid pool parts 10a and 10b are formed in the position in the side wall part 1c which counters mutually, respectively.
[0023]
The substrate blockade mouth 5 is blockaded with the plate-like substrate 3 to such a plating tub 1. The substrate 3 blockades the substrate blockade mouth 5 by being inserted in the guide part 20 by the substrate fastener 11. That is, the substrate 3 can be easily desorbed from the outside of the plating tub 1. Therefore, clearing work of the substrate 3 can be performed easily.
[0024]
The anode 2 is held by the anode attaching part 21, and the anode holding fixture 21 is being fixed to the guide part 8 via the connecting tool 12. Here, the anode feed port 7 and the substrate blockade mouth 5 have countered, and the anode 2 has countered the substrate 3 so that the surface of the anode 2 may become parallel to the surface of the substrate 3. Although the anode 2 is constituted from this embodiment by copper, it is not limited to copper. What is necessary is just to change suitably according to the plating film which it is going to form on the surface of the substrate 3. For example, what is necessary is for the anode 2 just to also consist of silver, when the plating film which it is going to form on the surface of the substrate 3 is silver.
[0025]
The anode 2 and the substrate 3 are electrically connected via the power supply 13. Therefore, it is possible to impress voltage between the anode 2 and the substrate 3 by the operation of the power supply 13. The substrate 3 should just have a layer which comprises a conductive material. That is, the whole may be a layer which comprises a conductive material, only some layers may comprise a conductive material and the remaining layers may comprise an insulating material.
[0026]
Drawing 2 is a perspective view showing the hollow member 4 of drawing 1. Between the anode 2 and the substrate 3, as shown in drawing 2, two or more tubular hollow members 4 are formed. Specifically, two or more tubular hollow members 4 are arranged in parallel mutually. Here, the hollow member 4 is arranged so that it may become parallel to the surface of the anode 2. As for the hollow member 4, it is preferred to be arranged in parallel, i.e., horizontally, with the oil level of the plating liquid L from a viewpoint of raising more the homogeneity of the thickness of the plating film formed in the surface of the substrate 3.
[0027]
The both ends of two or more hollow members 4 are connected to the tabular member 22, and the liquid pool parts 10a and 10b are closed by the tabular member 22. And the plating liquid L attracted from two or more hollow members 4 gathers in the liquid pool parts 10a and 10b.
[0028]
Here, the hollow member 4 is explained in detail. In each hollow member 4, two or more suction holes 4a are formed, and two or more suction holes 4b are formed in the anode 2 side also at the anode 2 and opposite hand 3, i.e., substrate, side. Here, if it states more concretely, two or more suction holes 4a are formed with the constant interval, for example along the lengthen direction of the hollow shape member 4. The outlets 4c and 4d which discharge the plating liquid L introduced inside the hollow member 4 through the suction holes 4a and 4b on the outside of the hollow member 4 are formed in the both ends of the hollow member 4. The aperture of the suction holes 4a and 4b is just 0.5-300 mm.
[0029]
The both ends of the hollow member 4 are connected to the liquid pool parts 10a and 10b formed in the side wall part 1c of the plating tub 1 via the tabular member 22, respectively, and the plating liquid L attracted from the suction holes 4a and 4b is discharged from the plating tub 1

through the two liquid pool parts 10a and 10b.
[0030]
Although the hollow member 4 may comprise a conductive material or may comprise an insulating material, it is preferred to be constituted from a viewpoint of making more electric field distribution between the anode 2 and the substrate 3 into homogeneity, by an insulating material. As such an insulating material, ceramics, a synthetic resin, etc. can be used, for example.
[0031]
The plating liquid exhaust pipes 15a and 15b are connected to each of the two liquid pool parts 10a and 10b formed in the side wall part 1c of the plating tub 1, and the plating liquid exhaust pipe 15a, It is connected to the plating liquid accommodation tank 16, and the plating liquid exhaust pipe 15b joins in the middle of the plating liquid exhaust pipe 15a. The plating liquid suction pump P1 is installed in the plating liquid exhaust pipe 15a. For this reason, the plating liquid L in the plating tub 1 is attracted through the suction holes 4a and 4b of the hollow member 4, and it is discharged by the operation of the plating liquid suction pump P1 from the plating tub 1 through the liquid pool parts 10a and 10b. Plating liquid filter F1 may be provided in the plating liquid exhaust pipe 15a. In this case, it becomes possible to remove a black film, sludge, garbage, etc. according to plating liquid filter F1. The suction means is constituted from this embodiment by the liquid pool parts 10a and 10b, the plating liquid exhaust pipes 15a and 15b, and the plating liquid suction pump P1.
[0032]
The plating liquid introducing pipes 17a and 17b are connected to the pars-basilaris-ossis-occipitalis plating liquid feed port 6, the plating liquid introducing pipe 17a is connected to the plating liquid accommodation tank 16, and the plating liquid introducing pipe 17b joins in the middle of the plating liquid introducing pipe 17a. And the plating liquid introduction pump P2 is installed in the plating liquid introducing pipe 17a. For this reason, the plating liquid L accommodated in the plating liquid accommodation tank 16 is introduced in the plating tub 1 from the pars-basilaris-ossis-occipitalis plating liquid feed port 6 through the plating liquid introducing pipes 17a and 17b with the plating liquid introduction pump P2. The plating liquid filter F2 may be formed in the plating liquid introducing pipe 17a. In this case, it becomes possible to remove a black film, sludge, garbage, etc. with the plating liquid filter F2.
[0033]
On the other hand, the plating liquid introducing pipes 18a and 18b are connected also to the top plating liquid feed port 9, and the plating liquid introducing pipe 18b is connected to the portion between the plating liquid accommodation tank 16 and plating liquid filter F1 among the plating liquid introducing pipes 18a. For this reason, the plating liquid L which passed plating liquid filter F1 in the plating liquid exhaust pipe 15a is introduced in the plating tub 1 from the top plating liquid feed port 9 through the plating liquid introducing pipes 18a and 18b.
[0034]
Next, an operation of the plating device 100 mentioned above is explained.
[0035]
The plating liquid introduction pump P2 is operated first, and the plating liquid L is introduced in the plating tub 1 through the plating liquid introducing pipes 17a and 17b and the pars-basilaris-ossis-occipitalis plating liquid feed port 6 from the plating liquid accommodation tank 16. The plating liquid L is introduced until the anode 2 and the substrate 3 are immersed. And if the oil level of the plating liquid L reaches a predetermined level, the plating liquid suction pump P2 will be operated. Thereby, the plating liquid L in the plating tub 1 is attracted by the hollow member 4 from the suction holes 4a and 4b, and is discharged from the plating tub 1 through the liquid pool parts 10a and 10b. And it is accommodated in the plating liquid accommodation tank 16 through the plating liquid exhaust pipes 15a and 15b from the liquid pool parts 10a and 10b. In this way, by performing the introduction and discharge of the plating liquid L in the plating tub 1, it will be

in the state where the plating liquid L is always stirred, and the concentration of the metal ion in the plating liquid L will be maintained uniformly. At this time, a suction flow rate and an exhaust flow in particular are not restricted. For example, what is necessary is just to adjust a suction flow rate and an exhaust flow suitably in the range of 1 - 20 L/min.

[0036]

Next, voltage is impressed between the anode 2 and the substrate 3 according to the power supply 13. Then, the metal which constitutes the anode 2 adheres on the surface of the substrate 3 by electrolysis of the plating liquid L, and a plating film is formed. According to this embodiment, copper is used as a component of the anode 2. For this reason, the plating film which consists of copper is formed on the surface of the substrate 3.

[0037]

In this way, if electrolysis of the plating liquid L is continued, the black film which is a copper oxide will be formed on the surface of the anode 2, or the film by sludge in the plating liquid L, garbage, etc. will adhere. When this film becomes [ thickness ] uneven, in order that the electric field distribution between the anode 2 and the substrate 3 may be disturbed, there is a possibility of reducing the homogeneity of the thickness of the plating film formed on the surface of the substrate 3.

[0038]

However, in this embodiment, the plating liquid L is attracted through two or more suction holes 4a and 4b from the hollow member 4 provided between the anode 2 and the substrate 3. For this reason, it becomes possible to remove uniformly the film formed on the surface of the anode 2. For this reason, the homogeneity of the thickness of the plating film which disturbing the electric field distribution between the anode 2 and the substrate 3 is fully prevented, and is formed in the surface of the substrate 3 by extension fully improves.

[0039]

In this embodiment, the plating liquid L is discharged from the outlets 4c and 4d in the both ends of the hollow member 4. That is, the plating liquid L is discharged from two places. For this reason, the homogeneity of the thickness of the plating film which can make small the difference of the suction force in each suction hole 4a, and it becomes possible to remove more the film formed in the surface of the anode 2 to homogeneity, and is formed in the surface of the substrate 3 by extension can more fully be raised.

[0040]

That is, when attracting the plating liquid L only, for example from the outlet 4c, in the suction holes 4a and 4b of the side near the outlet 4c, a suction force is large, and a suction force is small in the suction holes 4a and 4b of a side far from the outlet 4c. For this reason, there is a possibility that the difference of a suction force may become large by the suction holes 4a and 4b near the outlet 4c and the far suction holes 4a and 4b. In that respect, in this embodiment, since the plating liquid L is attracted also from 4d of another outlets, the fall of the suction force in the suction holes 4a and 4b far from the outlet 4c is fully prevented. Therefore, the homogeneity of the plating film which can make small enough the difference of the suction force in each suction holes 4a and 4b, and is formed in the surface of the substrate 3 by extension can more fully be raised. This invention is effective especially when longer than the case where the tubular hollow member 4 is short.

[0041]

In this embodiment, when the hollow member 4 is arranged horizontally, the fluid pressure in each suction hole 4a becomes equal. For this reason, compared with the case where the hollow member is not arranged horizontally, it can become possible to make small the difference of the suction force by the difference in the fluid pressure in each suction hole, and the homogeneity of the plating film formed in the surface of the substrate 3 can more fully be raised.

[0042]

This invention is not limited to the above-mentioned embodiment. For example, in the above-mentioned embodiment, although the hollow member 4 is tubular, the hollow member which constitutes the plating device of this invention may be tabular, as shown in drawing 3. The hollow member 24 in this case comprises the annular side wall part 26 which connects the plate-like parts 25a and 25b of a couple, and the plate-like parts 25a and 25b of a couple, as shown in drawing 3. Two or more suction holes which are not illustrated are formed in the plate-like part 25a, and two or more suction holes 27b are formed in the plate-like part 25b. And two or more outlets 28 which make the outside of the hollow member 24 discharge the plating liquid introduced inside the hollow member 24 through the suction hole 27b are formed in the side wall part 26. In this case, as shown by the two-dot chain line of drawing 3, the tube 29 which leads the plating liquid inside the hollow member 24 to the liquid pool parts 10a and 10b is connected to each outlet 28.

[Example]

[0043]

Hereafter, although the contents of this invention are more concretely explained using an example, this invention is not limited to the following example.

[0044]

(Example 1)

The plating film was formed on the surface of a substrate as follows using the plating device shown in drawing 1. That is, the plating liquid introduction pump P2 was operated first, and the plating liquid L was introduced in the plating tub 1 through the plating liquid introducing pipes 17a and 17b and the pars-basilaris-ossis-occipitalis plating liquid feed port 6 from the plating liquid accommodation tank 16. At this time, the plating liquid L consisted of copper sulfate and 5 hydrate ($CuSO_4$and$5H_2O$), sulfuric acid ($H_2SO_4$), chloride (HCl), and a polyethylene glycol. The plating liquid L was introduced until the anode 2 and the substrate 3 were immersed. And when the oil level of the plating liquid L reached the predetermined level, the plating liquid suction pump P1 was operated, and the plating liquid L was made to discharge from the plating tub 1. At this time, each of suction flow rates and exhaust flows was taken as 10 L/min.

[0045]

Next, according to the power supply 13, voltage was impressed between the anode 2 and the substrate 3 so that the current density between the anode 2 and the substrate 3 might serve as 2 $A/dm^2$. In this way, the plating film which consists of copper was formed on the surface of the substrate 3.

[0046]

In this way, about the formed plating film, the variation in thickness was investigated with the contact process thickness measurement device (a sensing pin type surface type-like measuring instrument, the product made from Dektak). As a result, the average thickness of a plating film is 10 micrometers, and the variation from average thickness is **5%.

It turned out that it is sufficiently small.

[0047]

According to the plating device of this invention, from this, it was checked that the homogeneity of the plating thickness formed on a substrate face can fully be raised.

[Brief Description of the Drawings]

[0048]

[Drawing 1]Drawing 1 is drawing of longitudinal section showing one embodiment of the plating device concerning this invention.

[Drawing 2]Drawing 2 is a perspective view showing the hollow member of drawing 1.

[Drawing 3]Drawing 3 is a perspective view showing the modification of a hollow member.

[Description of Notations]
[0049]
1 [ — A hollow member, 4a, 4b / — A suction hole, 4c 4d / — An outlet, 100 / — Plating device. ] — A plating tub, 2 — An anode, 3 — A substrate, 4

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[Translation done.]

* NOTICES *



1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

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## CLAIMS

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[Claim(s)]
[Claim 1]
A plating tub which stores plating liquid,
An anode provided in said plating tub,
A substrate which counters said anode, is formed and functions as a cathode,
A tubular or tabular hollow member provided between said anode and said substrate,
A suction means which makes said plating liquid attract through said hollow member,
A preparation,
Said hollow member,
It has two or more suction holes formed in said anode side, and an outlet which makes the outside of said hollow member discharge plating liquid introduced inside said hollow member through said two or more suction holes by said suction means,
A plating device.
[Claim 2]
The plating device according to claim 1 with which two or more suction holes are further formed in said anode and an opposite hand in said hollow member.
[Claim 3]
The plating device according to claim 1 or 2 with which said hollow member is arranged horizontally.
[Claim 4]
The plating device according to any one of claims 1 to 3 with which said hollow member is provided with two or more said outlets.

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[Translation done.]